Check List the journal of biodiversity data
NOTES ON GEOGRAPHIC DISTRIBUTION

Confirmed record of *Bacopa sessiliflora* (Benth.) Edwall (Plantaginaceae) in the Brazilian Cerrado

Mateus C. A. Pestana[1], Rafael F. Oliveira[2], Carlos N. D. Durval[3], Amabille M. Barroso[3], Neuriane P. F. Alves[4], Maria da Conceição C. Bastos[5], Vanessa F. Ferreira[3], Diego S. Campos[6], Raysa V. C. Saraiva[4]

1 *Programa de Pós-Graduação em Biodiversidade e Meio Ambiente, Universidade Federal da Grande Dourados, Dourados, MS, Brazil*
2 *Programa de Pós-Graduação em Biodiversidade e Conservação, Universidade Federal do Maranhão, São Luís, MA, Brazil*
3 *Universidade Federal do Maranhão, Centro de Ciências de Chapadinha, Chapadinha, MA, Brazil*
4 *Grupo de pesquisa em Biodiversidade e Interdisciplinaridade em Ensino de Ciências Naturais, Universidade Federal do Maranhão, Pinheiro, MA, Brazil*
5 *Programa de Pós-Graduação em Ciências Ambientais, Universidade Federal do Maranhão, Chapadinha, MA, Brazil*
6 *Programa de Pós-Graduação em Biodiversidade e Biotecnologia da Amazônia Legal – Rede BIONORTE, Universidade Federal do Maranhão, São Luís, MA, Brazil*

Corresponding author: *Mateus C. A. Pestana (mcapestanabotanist@gmail.com)*

Abstract. *Bacopa sessiliflora* (Benth.) Edwall (Plantaginaceae) is an aquatic herb that inhabits the banks of watercourses in the Neotropics. In this study, we confirmed the occurrence of the species in the Cerrado following a field collection on the banks of the Preto River, in eastern Maranhão state, Brazil, and the study of herbarium materials. A morphological description, illustrations, phenological data, and a distribution map of *B. sessiliflora* are provided. The new data highlight the importance of permanent protected areas, especially riverbanks, as crucial habitats for increasing our understanding of plant biodiversity in Maranhão.

Key words. Gratioleae, Lamiales, Maranhão, riparian vegetation, taxonomy

Pestana MCA, Oliveira RF, Damasceno-Durval CN, Barroso AM, Bastos MCC, Ferreira VF, Campos DS, Alves NPF, Saraiva RVC (2024) Confirmed record of *Bacopa sessiliflora* (Benth.) Edwall (Plantaginaceae) in the Brazilian Cerrado. Check List 20 (3): 607–613. https://doi.org/10.15560/20.3.607

INTRODUCTION

Bacopa Aubl. (Plantaginaceae) is the largest genus of the tribe Gratioleae (Souza and Giulietti 2009), comprising approximately 60 species distributed predominantly in the tropical and subtropical regions, especially in the New World (Tippery et al. 2024). The greatest species richness is found in the wetlands of South America (~70% of the diversity), but *Bacopa* is also well represented in Africa and North America (Scatigna et al. 2022; Tippery et al. 2024). There are 29 species in Brazil, eight of which are endemic to the country (Souza 2020). In Maranhão, 14 species are cited in the literature (Souza et al. 2020; Pestana et al. 2023).

The genus *Bacopa* shows great variation in the habit and life form of its species (Gonzalez-Socoloske et al. 2020), covering a variety of humid environments, from palustrine (amphibious plants) and fully aquatic (emergent, submerged, and floating plants) (Souza and Giulietti 2009; Scatigna et al. 2022; Pestana et al. 2023). The main diagnostic characteristics for identifying *Bacopa* include a calyx composed of three wider outer sepals, surrounding two narrower inner sepals; sepals that are generally subequal, rarely equal to subequal; and anthers with parallel or convergent, contiguous thecae (Pennell 1946; Souza and Giulietti 2009). However, these characteristics, although distinctive, are not synapomorphies of *Bacopa* (Scatigna et al. 2022). The only morphological synapomorphy of the genus is the presence of anthers with parallel or convergent thecae; that is, the anthers are not separated by the arms of the connective (Scatigna et al. 2022).

Bacopa sessiliflora (Benth.) Edwall is a common species in the Neotropics, occurring in Central America (Belize, Costa Rica, Cuba, Guatemala, Honduras, Jamaica, Nicaragua, and Panama), North America (Mexico and Dominican Republic), and South America (Brazil, Colombia, Ecuador, Guyana, French Guiana, Trinidad and Tobago, Suriname, and Venezuela) (POWO 2024). In Brazil, the species is currently reported in the Amazon and Caatinga biomes (*sensu* IBGE 2019; Flora e Funga do Brasil 2024). However, recent fieldwork resulted in the collection of the species within the boundaries of the Cerrado biome (*sensu* IBGE 2019). In this context, we confirm the first record of *Bacopa sessiliflora* in the Brazilian Cerrado, including a morphological description, phenological and habitat data, a distribution map, and illustrations of the species. In addition, we discuss the importance of preserving the Brazilian Cerrado, highlighting the need for additional

OPEN ACCESS

Academic editor: Matias Köhler
Received: 14 February 2024
Accepted: 26 April 2024
Published: 10 May 2024

Copyright © The authors. This is an open-access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0)

studies, especially in Permanent Preservation Areas (PPAs), such as riparian forests and other watercourses, which are often neglected in floristic studies.

METHODS

The specimen of *Bacopa sessiliflora* used in the present study was collected during a field expedition in January 2024 along the banks of the Preto River, São Benedito do Rio Preto municipality, state of Maranhão, Brazil (Figure 1F). The botanical material was herborized following the methods of Fidalgo and Bononi (1989) and identified based on the taxonomic treatment of *Bacopa* for Brazil by Souza (2020), as well as consulting specialized literature (Pennell 1946; Souza and Giulietti 2009). Vouchers of the collected samples were deposited at Centro de Ciências Agrárias e Ambientais herbarium (**CCAA**), at the Federal University of Maranhão, Chapadinha, Brazil.

The description provided here is based on the specimen collected. The morphological terminology used in the species description follows Souza and Giulietti (2009). Data on the species distribution was obtained from the GBIF (2024), Flora e Funga do Brasil (2024), and SpeciesLink (CRIA 2024) databases, from which we extracted the georeferenced records to produce the species' occurrence map (see supplementary material), prepared using QGIS v. 3.34.3 (Qgis Development Team 2023; Figure 2). For the illustration of the species, samples were preserved in 70% alcohol and examined with a stereomicroscope (Figure 3). Phenological and habitat data was obtained through field observations and supplemented with information on the labels of the samples consulted on the mentioned platforms.

The general characterization of the Cerrado followed Ribeiro and Walter (2008), a regional classification whose phytophysiognomies of this biome can be described in grassland, savanna, and forest formations. In this classification, the phytophysiognomy of the riparian forest is inserted in the forest formations of the Cerrado biome (Ribeiro and Walter 2008; IBGE 2019), within an ecotone of savanna and seasonal tropical forest (IBGE 2012).

Figure 1. *Bacopa sessiliflora*. **A.** Habit. **B.** Glandular punctuations on the leaf blade. **C.** Branch. **D.** Axillary flower in lateral view. **E.** Roots. **F.** Habitat.

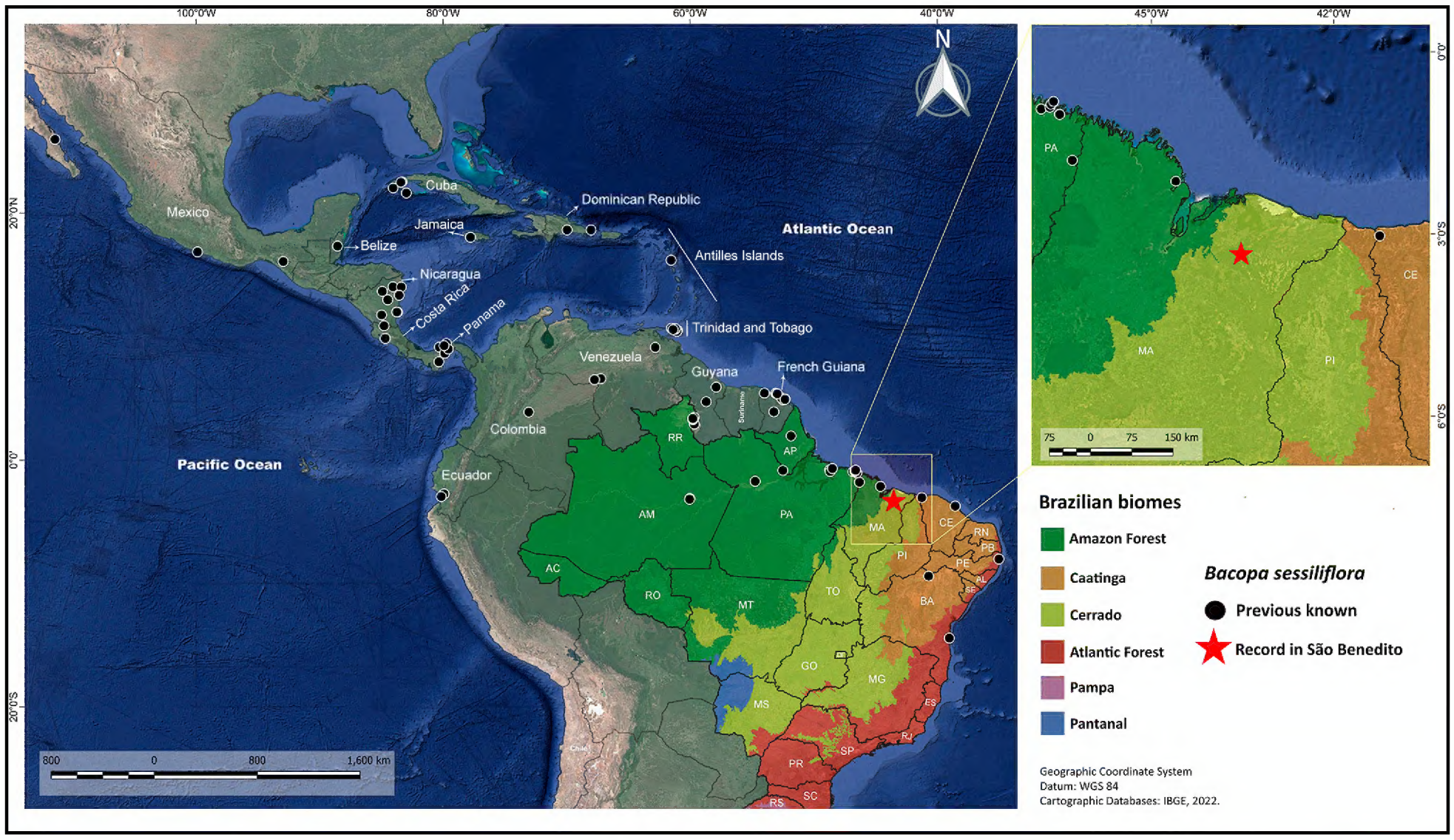

Figure 2. Global distribution map of *Bacopa sessiliflora*. Black circles = previous known records; red star = record in São Benedito. Map preparation: Rafael **F.** Oliveira.

RESULTS

***Bacopa sessiliflora* (Benth.) Edwall**, Bol. Commiss. Geogr. Estado de São Paulo 13: 175. (Edwall 1897).
Basionym: *Herpestis sessiliflora* Benth., Compan. Bot. Mag. 2: 58. (Bentham 1836).
Figures 1–3

Examined material. BRAZIL – **Maranhão** • Município de São Benedito do Rio Preto, Margem do Rio Preto; 03°20′19″S, 043°31′34″W; 13 m elev.; 13.I.2024; M. Pestana, N. Durval & A. Barroso 58 leg.; CCAA 4436.

Identification. **Herbs**, 9.5–24 cm tall, amphibious. **Roots** 4 cm long, fibrous, unbranched. **Stem** erect, glabrous, branched, quadrangular, rigid; internodes 0.5–3.5 cm. **Leaves** 1.2–3.9 × 0.3–0.6 cm, opposite, sessile, oblanceolate, base attenuated, semiamplexicaule, apex acute, margin serrate, glabrous, both sides with small brownish punctate glands; midvein adaxially canaliculate, abaxially conspicuous. **Flowers** small, inserted in the floral axils, 2 per axil, opposite, sessile, rare subsessile; the pedicel ca. 1 mm long in fruit; bracteoles 2, ca. 1.5 mm, opposite, linear to lanceolate, apex acute, inserted at the base of the calyx. **Calyx** green, glabrous, glandular-punctate; external sepals 3.4–4.8 × 0.15–0.25 mm, obovate, apex rounded or acute; internal sepals 2.1–2.6 × 0.5–0.8, lanceolate, apex acute, slightly shorter than the external sepals. **Corolla** zygomorphic, white, pentamerous; tube glabrous, glandular–punctate and pale yellow externally, ca. 1 cm; stamens 4, filet cylindrical, inserted in the center of the tube; anthers yellow, round; stigma plane, broad, recurved; stigma ca. 1 mm, eglandular, slightly bilobed; ovary 1.3 mm long, glandular–punctate. **Capsule** globose, 2.4–2.7 × 2.2–1.8 mm, apex obtuse, dark, tegument rigid; seeds numerous, ca. 0.3 mm, dark brown.

Comments. *Bacopa sessiliflora* is characterized by its herbaceous habit, quadrangular and glabrous branches, leaves with numerous glandular dots on each surface, and serrated margins in the upper half of the blade; the corolla is pentamerous, the flowers axillary, predominantly sessile, white, and with four stamens; the calyx is green, surrounded by two external sepals and two internal sepals, each unequal (Souza and Giulietti 2009). Souza (2020) notes that *B. sessiliflora* shares morphological similarities with *Bacopa imbricata* (Benth.) Pennell, differing primarily in the arrangement of flowers on the stems. In *B. sessiliflora*, the flowers are more spaced, contrasting with *B. imbricata*, where they are closer together, giving them a congested appearance.

In addition to the record in São Benedito do Rio Preto, we noted a previous collection identified as *B. sessiliflora* in the Cerrado of Maranhão (*N. Mota 2782*; RB 759845), from the municipality of Primeira Cruz, approximately 170 km from our collection at São Benedito do Rio Preto. However, although the RB 759845 record was identified as *B. sessiliflora* by a specialist, its duplicate housed in the UEC herbarium

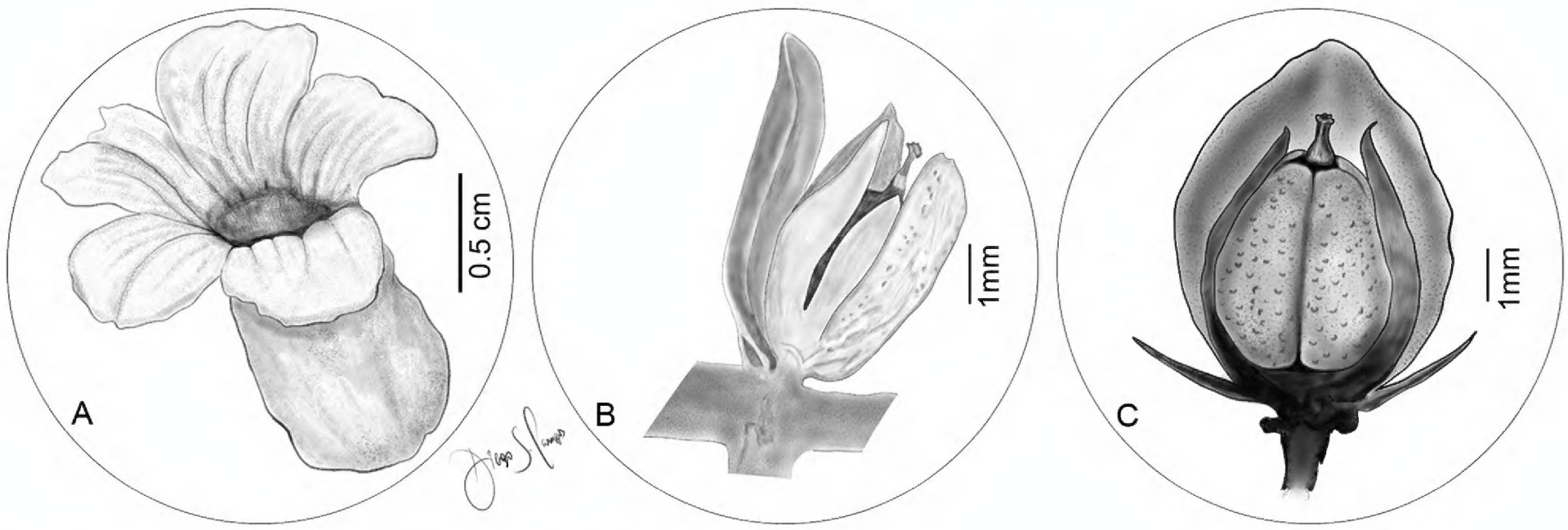

Figure 3. *Bacopa sessiliflora* **A.** Corolla. **B.** Calyx. **C.** Fruit. Drawing: Diego S. Campos.

under number 207760, also identified by a specialist in the group, is annotated as *Bacopa angulata* (Benth) Edwall. In fact, when checking the field observations on the labels of these records, the specimens are annotated as having a pink corolla with a white fauces, which corresponds to *B. angulata* as opposed to *B. sessiliflora*, which has a totally white corolla.

Other factors that suggest the identification of the sample as *B. angulata* refer to some morphological characters observed in RB 759845, for example, the presence of winged branches, leaves with a linear shape, and a long pedicel (>0.3 cm) on the fruits, which is in line with the description of this species in Souza (2020). Moreover, *B. angulata* shows a preference for seasonal lakes on the coast of Maranhão, being frequently documented on beaches on the eastern coast of the state and occasionally recorded on the western coast, where it was categorized as a annual plant (Guterres et al. 2019; CRIA 2024). In the region where *B. sessiliflora* was found, *B. angulata* is not a common species, being recorded only in neighboring municipalities, where it occurs is amphibious or emergent in seasonal flooded open fields (Pestana et al. 2024; CRIA 2024).

Phenology. In São Benedito do Rio Preto, was collected with flowers and fruits in January. In other localities, there are collections records from February to November.

Vernacular name. In some regions of Brazil it is known as "pataqueira" (Souza and Giulietti 2009).

DISCUSSION

The biomes of Maranhão may present transitional aspects due to its border positioning between two large biomes, the Cerrado and the Amazon (Saraiva et al. 2020). Under these conditions, it is common for heterogeneous environments to occur in terms of abiotic and biotic environmental filters; there is the presence of low altitudes where biogeographical barriers in the distribution of species can be overcome and there can be greater exchanges between elements of adjacent vegetation. In fact, results from floristic research have filled in gaps regarding the geographic distribution of species in the biomes of Maranhão (Saraiva et al. 2020; Pestana et al. 2022, 2024; Oliveira et al. 2022).

In the state of Maranhão, *Bacopa sessiliflora* is found in the Restinga areas of the Amazon and in the Cerrado of eastern and Maranhão, predominantly inhabiting riverbanks and watercourses, at 17–63 m a.s.l.. In São Benedito do Rio Preto, *B. sessiliflora* occurs along the banks of the Preto River, growing in flooded sandy soils in the phytophysiognomy of riparian forest, in the portion of the herbaceous-shrub stratum. The expansion of the geographic distribution of *B. sessiliflora*, including occurrence in the Cerrado of Maranhão in riparian forests, emphasizes that these forest physiognomies close to river courses have an important role as corridors, connecting Amazonian vegetation to these Cerrado physiognomies (Oliveira-Filho and Ratter 1995).

In addition to their botanical peculiarities, riparian forests provide fundamental ecosystem services for the conservation of life, maintaining hydrological cycles through ecosystem-support functions (Suzuki et al. 2022). Moreover, these areas play an important role in reducing impacts on aquatic biota and are directly related to the quality of water for human and animal use (Lima and Zakia 2009). According to the new Brazilian Forestry Code, marginal zones of all perennial and intermittent watercourses, excluding ephemeral ones, are designated as Permanent Preservation Areas (PPAs) from the edge of the channel of the regular riverbed (Brasil 2012). This classification gives legal and environmental importance to the areas where *B. sessiliflora* is found. Despite their designation as PPAs, most of these areas in Brazil often do not receive the necessary attention in botanical studies.

Efforts to understand the plant biodiversity of these regions are limited, as floristic and taxonomic studies are predominantly focused on state or national parks (e.g. Athiê-Souza et al. 2018; Araújo et al. 2020; Hammes et al. 2021; Santos et al. 2021). The scarcity of studies on PPAs not only represents a deficit in scientific knowledge but also increases the risk of underestimating the importance and vulnerability of these environments, especially in the Brazilian Cerrado, considered the cradle of Brazil's waters (Padovesi-Fonseca et al. 2015; Latrubesse et al. 2019) and historically neglected in terms of actions aimed at its preservation (Bastos et al. 2023).

To emphasize the importance of these studies, we note that *B. sessiliflora* coexists with a recently described species, *Dizygostemon riparius* Scatigna & Colletta, which was also collected on the banks of the Rio Preto in São Benedito do Rio Preto (Scatigna et al. 2019), close to where *B. sessiliflora* was collected. This highlights the importance of studies and filed collections in the Permanent Preservation Areas of the Cerrado. These efforts are essential for advancing our understanding and conservation of plant biodiversity in these regions.

ACKNOWLEDGEMENTS

We are grateful to Marineide Marques Barroso and Aguinaldo Araujo Barroso for the assistance in fieldwork. This work was supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), in the form of scholarships within the scope of their programs. CNPq grant for financing the project "Além da Flora do Brasil 2020: impulsionando a flora do Maranhão" (process number 402943/2021-0). Specifically, we acknowledge the following grants: the CAPES grant no. 88887.827645/2023-00 to Mateus C.A. Pestana, no. 88887.808704/2023-00 to Rafel F. Oliveira, no. 88887.827956/2023-00 to Maria da Conceição C. Bastos, and no. 88887.674455/2022-00 to Diego S. Campos. We also thank Rozijane F. Ottoni for the use of the CCAA Herbarium. We also thank Dr. Nicholas P. Tippery, Dr. Matias Köhler, and an anonymous reviewer for reviewing the manuscript.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Author contributions

Conceptualization: MCAP, CNDD, AMB. Data curation: MCAP, MCCB, VFF. Investigation: MCAP, AMB, CNDD, NPFA, MCCB. Methodology: MCAP, RFO, MCCB. Resources: MCAP, RFO, CNDD, AMB, NPFA, MCCB, VFF, DSC, RVCS. Supervision: RVCS. Visualization: MCAP, RFO, DSC. Writing – original draft: MCAP, RFO, CNDD, AMB, NPFA, MCCB, VFF, DSC, RVCS. Writing – review and editing: MCAP, RFO, CNDD, AMB, NPFA, RVCS.

Author ORCIDs

Mateus César Araújo Pestana https://orcid.org/0000-0001-6542-6721
Rafael Ferreira de Oliveira https://orcid.org/0000-0002-1659-2923
Carlos Nalberth Damasceno Durval https://orcid.org/0000-0003-1667-3202
Amabille Marques Barroso https://orcid.org/0000-0002-5851-3496
Neuriane Pinheiro Ferreira Alves https://orcid.org/0009-0004-8555-0665
Maria da Conceição de Carvalho Bastos https://orcid.org/0000-0001-9237-6221
Vanessa Fernandes Ferreira https://orcid.org/0009-0004-2608-7498
Diego Sousa Campos https://orcid.org/0000-0001-8262-413X
Raysa Valéria Carvalho Saraiva https://orcid.org/0000-0002-0893-7338

Data availability

Geographic coordinates of *Bacopa sessiliflora* utilized in this study are available in figshare (https://doi.org/10.6084/m9.figshare.25139195).

REFERENCES

Araújo EA, Kunz SH, Dias HM, Zorzanelli JPF, Callegaro RM (2020) Vascular plant checklist in an area of extreme biological importance: filling gaps in the Caparaó National Park-ES, Brazil. Biota Neotropica 21: 1–19. https://doi.org/10.1590/1676-0611-bn-2020-1024

Athiê-Souza SM, Melo JIM, Silva LPD, Santos LL, Santos JSD, Oliveira LSD, Sales MFD (2018) Phanerogamic flora of the Catimbau national park, Pernambuco, Brazil. Biota Neotropica 19: 1–27. https://doi.org/10.1590/1676-0611-bn-2018-0622

Bastos MCC, Pestana MCA, Oliveira RF (2023) Legislative inertia fails Brazil's Cerrado. Science 382: 1008–1008. https://doi.org/10.1126/science.adm7683

Bentham G (1836) Observations on some new, or little known genera and species of Scrophulariaceae. In: Hooker WJ Companion to the Botanical magazine: being a journal, containing such interesting botanical information as does not come within the prescribed limits of the magazine; with occasional figures. E. Conchman, London, England. 53–60.

Brasil (2012) Lei nº 12.651, de 25 de maio de 2012. https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm. Accessed on: 2024–01–20.

CRIA (2024) SpeciesLink. http://www.splink.org.br. Accessed on: 2024-01-20.

Edwall G (1897) Scrophulariaceae. In: Loefgren A (Ed) Boletim da Commissao Geographica e Geologica do Estado de Sao Paulo. Flora Paulista 2, Sao Paulo, Brazil. 175–176.

Fidalgo O, Bononi VLR (1989) Técnicas de coleta, preservação e herborização de material botânico. Instituto de Botânica, São Paulo, Brazil, 62 pp.

Flora e Funga do Brasil (2024) Jardim Botânico do Rio de Janeiro. https://reflora.jbrj.gov.br/reflora/. Accessed on: 2024-01-20.

GBIF (2024) Global Biodiversity Information Facility. https://www.gbif.org/. Accessed on: 2024-01-—20.

Gonzalez-Socoloske D, Tippery NP, Jiménez Pérez NC, Les DH (2020) New record of *Bacopa egensis* (Plantaginaceae) for the flora of Mexico. Journal of the Botanical Research Institute of Texas 14 (2): 395–403. https://doi.org/10.17348/jbrit.v14.i2.1017

Guterres AVF, Amorim IFF, Silva AFC, Almeida Jr EB (2019) Flora do estrato herbáceo da restinga da praia do Caúra, São José de Ribamar, Maranhão. Boletim do Laboratório de Hidrobiologia 29 (2): 1–10. https://doi.org/10.18764/1981-6421e2019.8

Hammes JK, Silva MGD, Kameyama C, Temponi LG (2021) Flora of Acanthaceae of Iguaçu National Park, Paraná, Brazil. Rodriguésia 72: 1–15. https://doi.org/10.1590/2175-7860202172007

IBGE (2012) Manual técnico da vegetação brasileira: sistema fitogeográfico, inventário das formações florestais e campestres, técnicas e manejo de coleções botânicas, procedimentos para mapeamentos. Instituto Brasileiro de Geografia e Estatística , Rio de Janeiro, Brazil, 275 pp.

Latrubesse EM, Arima E, Ferreira ME, Nogueira SH, Wittmann F, Dias MS, Dagosta FCP, Bayer M (2019) Fostering water resource governance and conservation in the Brazilian Cerrado biome. Conservation Science and Practice 1: 1–8. https://doi.org/10.1111/csp2.77

Lima WP, Zakia MJB (2009) Hidrologia de matas ciliares. In: Rodrigues RR, Leitão-Filho HF (Eds) Matas ciliares: conservação e recuperação. Edusp, São Paulo, Brasil. 33–44.

Oliveira MS, Silva-Junior WR, Silva EO, Saraiva RVC, Ferreira AWC (2022) First report of *Hippeastrum puniceum* (Lam.) Kuntze (Amaryllidaceae) from the state of Maranhão, Brazil, and expansion of the geographical distribution of *Alophia drummondii* (Graham) R. Foster (Iridaceae) and *Rapatea paludosa* Aubl.(Rapateaceae). Check List 18 (2): 323–330. https://doi.org/10.15560/18.2.323

Oliveira-Filho AT, Ratter JA (1995) A study of the origin of central Brazilian forests by the analysis of plant species distribution patterns. Edinburgh Journal of Botany 52: 141–194. https://doi.org/doi:10.1017/S0960428600000949

Padovesi-Fonseca C, Martins-Silva MJ, Puppin-Gonçalves CT (2015) Cerrado's areas as a reference analysis for aquatic conservation in Brazil. Biodiversity Journal 6: 805–16.

Pennell FW (1946) Reconsideration of the *Bacopa-Herpestis* problem of the Scrophulariaceae. Proceedings of the Academy of Natural Sciences of Philadelphia 98: 83–98.

Pestana MCA, Hora RC, Guarçoni EAE (2024) Floristic survey of aquatic macrophytes in eastern Maranhão, Brazil: richness, biological forms and three new records. Brazilian Journal of Biology 84: 1–12. https://doi.org/10.1590/1519-6984.281276

Pestana MCA, Mendonça NA, Oliveira RF, Bastos MCC, Silva MI, Barroso AM, Hora RC, Guarçoni EAE (2022) First records of *Utricularia breviscapa* C. Wright ex Griseb. (Lentibulariaceae) for Maranhão state, northeastern Brazil. Check List 18 (4): 861–866. https://doi.org/10.15560/18.4.861

Pestana MCA, Oliveira RF, Scatigna AV, Saraiva RVC, Silva MI, Bastos MCC, Guarçoni EAE (2023) *Bacopa egensis* (Poepp.) Pennell (Plantaginaceae): new records from Northeast Brazil and the Cerrado domain. Check List 19 (2): 191–197. https://doi.org/10.15560/19.2.191

POWO (2024) Plants of the world online. http://www.plantsoftheworldonline.org/. Accessed on: 2024-01-20.

QGIS Development Team (2023) QGIS Geographic Information System. Open-Source Geospatial Foundation Project. http://qgis.osgeo.org. Accessed on: 2024-01-25.

Ribeiro JF, Walter BMT (2008) As principais fitofisionomias do Bioma Cerrado. In: Sano SM, Almeida SP, Ribeiro JF (Eds) Cerrado: ecologia e flora. Embrapa Informação Tecnológica, Brasília, Brazil, 153–212.

Santos PSN, Oliveira MIU, Couto-Santos APLD, Funch LS (2021) Diversity of Myrtaceae in and surroundings the Chapada Diamantina National Park, Brazil. Rodriguésia 72: https://doi.org/10.1590/2175-7860202172098

Saraiva RVC, Leonel LV, Reis FF, Figueiredo FAMMA, Reis FO, Souza JRP, Muniz FH, Ferraz TM (2020) Cerrado physiognomies in Chapada das Mesas National Park (Maranhão, Brazil) revealed by patterns of floristic similarity and relationships in a transition zone. Anais da Academia Brasileira de Ciências 92 (2): 1–16. https://doi.org/10.1590/0001-3765202020181109

Scatigna AV, Brandão CM, Colletta GD, Teles RDM, Cavalcante KSB, Souza VC, Simões AO (2019) *Dizygostemon riparius* (Plantaginaceae, Gratioleae), a new species from Maranhão, northeastern Brazil. Willdenowia 49 (2): 177–186. https://doi.org/10.3372/wi.49.49206

Scatigna AV, Souza VC, Sosa MLM, Colleta GD, Machado RM, Simões AO (2022) Phylogenetics of Gratioleae (Plantaginaceae): paraphyly of *Stemodia* and its implications for generic circumscriptions, with insights from floral evolution. Botanical Journal of the Linnean Society 200 (2): 194–217. https://doi.org/10.1093/botlinnean/boac013

Souza VC (2020) *Bacopa*. In: Flora e funga do Brasil. Jardim Botânico do Rio de Janeiro. https://floradobrasil.jbrj.gov.br/FB86692. Accessed on: 2024-01-25.

Souza VC, Giulietti AM (2009) Levantamento das espécies de Scrophulariaceae *sensu lato* nativas do Brasil. Pesquisas, Botânica 60: 7–288.

Suzuki LPZ, Costa TG, Sousa NFM (2022) Mapeamento dos serviços ecossistêmicos de Áreas de Preservação Permanente de cursos d'água: estudo de caso da bacia do rio Doce. Diversitas Journal 7 (4): 2507–2522. https://doi.org/10.48017/dj.v7i4.2049

Tippery NP, Gonzalez-Socoloske D, Leliaert F, Thompson TA, Scatigna AV, Souza VC (2024) Systematics and biogeography of *Bacopa* (Plantaginaceae). Plant Systematics and Evolution 310 (1): 1–22. https://doi.org/10.1007/s00606-023-01884-w